QUARTERLY REPORT

1. **Contract Number:** DAMD17-91-C-1081

2. **Report Date:** 13 September 1993

3. **Reporting Period:** 16 May 1993 to 15 August 1993

4. **Principal Investigator:** Dr. Robert W. Verona

5. **Telephone:** (205) 598-6389, FAX (205) 598-9256

6. **Institution:** UES, Inc.
4401 Dayton-Xenia Road
Dayton, Ohio 45432

7. **Project Title:** Development of Data Packages on the Human Visual Response with Electro-optical Displays

8. **Current staff, with percent effort of each on project:**

NAME	TITLE	HOURS*	% OF EFFORT
Dr. Robert W. Verona	Engineering Psychologist	188	90%**
Dr. Victor Klymenko	Research Psychologist	452	90%
Mr. Howard H. Beasley	Electronics Technician	432	86%
Mr. John S. Martin	Electro-optics Technician	483	96%

* 504 hours were available this reporting period not including holidays. The above hours are the actual hours worked (sick leave and vacation have been subtracted).

** 208 hours were available this reporting period not including holidays. The above hours are the actual hours worked (sick leave and vacation have been subtracted). As of 21 June 1993 Dr. Verona was on sick leave and short term disability.

9. **Contract expenditures to date:**

Personnel	$521,308.40	Equipment & Supplies	$ 3,908.05
Travel	10,617.55	Other	4,597.31
		TOTAL*	$540,533.70

* Does not include facilities capital and G&A expense.

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10. Comments on administrative and logistics matters:

Building construction has continued to disrupt (e.g. noise, heat, dust) the office work area for most of this reporting period.

A laboratory wide review and analysis of facilities and research programs was conducted by MRDC headquarters personnel. For this review UES personnel prepared posters, and a demonstration/discussion of the equipment and testing procedures used in our program.

11. Scientific Progress:

Physical Measurements:

Four flat panel displays, representing different display technologies, are being configured to computers for demonstrations. The four types of display are liquid crystal display, color liquid crystal display, plasma display and electroluminescent display. Configuration of the physical interface connections, including the wiring harnesses was completed. The mounting frames have been designed and fabricated. Parts from a number of non-functional computers have been utilized to drive the flat panel displays. Software for demonstrating graphic images on the flat panels has been written. The VII pattern generator was acquired and configured to output to one of the flat panels for testing.

The measurement procedures, the equipment and the software created for evaluating the performance of night vision devices in three areas--field-of-view, magnification, and distortion has been documented for an upcoming report. The preparation of the methodology report documenting the hardware and the control software used in measuring the night vision devices has begun. For this report, the field-of-view, magnification and distortion measurement system was reconfigured and calibrated to make verification checks with the ANVIS.

Physical measurements were made on the high resolution color monitor used in the visual perception studies. Both the static and the dynamic contrast and luminance measurement techniques were further refined and perfected and tested for repeatability. This included re-configuring the measurement equipment to refine the process so that it could accurately measure contrast in the highest spatial frequency stimuli (smallest patterns) used in the experiment. The software was also modified to make it more efficient. The physical contrast measurements of these spatio-temporally modulated stimuli is complete including the complete contrast range available on the display monitor (0-255 digital units) for 16 different spatio-temporal stimulus variations (four spatial frequencies x four temporal frequencies). Graphs were generated for each stimulus variation, analyzing the functional relationship between digital signal level (0-255) and luminance, and between digital signal level and various contrast formulas. New measurements of the physical contrast threshold as a measure of visual performance were needed to incorporate

into the statistical analysis of the upcoming report on the limits experiment (Experiment 1A under the protocol). The physical measurement techniques will be documented in a separate report.

Also supported during this reporting period were night vision device tests in the measurement laboratory and in the field. The physical measurement data were reported to Major Rabin for inclusion in a government report.

Psychophysical Measurements:

Last quarter two reports were completed in draft form of the visual performance experiments. These were the "luning" experiment (Experiment 2 under the protocol "Psychophysical Assessment of Visual Parameters in Electro-optical Display Systems") and the "fragmentation" experiment (under a protocol amendment). These reports will be submitted in final form early next quarter.

In the previous reporting of the data for the limits experiment "Binocular Viewing Mode affects Spatio-Temporal Contrast Threshold," presented at the Association for Research in Vision and Ophthalmology (May 1993) estimates of the physical contrasts based on our initial measurements were used. At that time the measurement techniques were still under development and being tested. As noted above, these physical contrast measurement techniques have been further refined during this last quarter, and tested for repeatability. A new series of measurements have been taken which will be used in the final report on the limits experiment.

Milestones:

The two technical reports (on luning and on fragmentation) are in the final stages of the review process. Also being completed is a third report (on threshold limits) following incorporation of the new dynamic display measurements into the statistical analysis. Separate technical reports on the physical measurement techniques developed here (field-of-view, magnification and distortion measurements of night vision devices and contrast measurements of visual stimuli) are in preparation. It is expected that versions of some of these reports will be submitted to the open literature.

In addition to the completion of the reports, efforts for the next quarter, based upon discussions with Dr. Wiley, will focus on three new (abbreviated) research protocols. The protocols, to be submitted, will be on aspects of binocular vision relevant to helmet-mounted displays. The issues to be addressed include the effect on visual performance on the following: (1) binocular misalignment, (i.e., visual tolerance for misalignment), (2) binocular brightness differences, and (3) defocus in one eye. Literature search and the assessment of the software and equipment requirements for the abbreviated protocols was begun. Dr. McLean will be consulted with, on the assessment of the optical equipment requirements for the third protocol.